MICROCOM®
Temperature Controller

Instruction Manual

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MICROCOM® TEMPERATURE CONTROLLER INSTRUCTION MANUAL INTRODUCTION

1.1 MAIN FUNCTION:

The MICROCOM® temperature controller is designed to control hot runner systems.

1.2 CONTROLLER SPECIFICATIONS:

- INPUT POWER: 230 VAC single phase.
- INPUT POWER RANGE: 207 VAC to 253 VAC.
- MAXIMUM OUTPUT POWER: 3600W. (15 Amps).
- FREQUENCY: 60Hz / 50Hz.

A label is affixed to the cabinet indicating:

1.3 TECHNICAL FEATURES:

1.3.1 TEMPERATURE MEASUREMENT:

- Thermocouple type J (“J” display) or type K (“nI” display), grounded or ungrounded, with automatic cold junction compensation (selection of the thermocouple in the configuration menu).
- Sampling rate, 83 ms @ 60 Hz or 10 ms @ 50Hz.
- Accuracy +/- 0.5% over the range 32 to 932 °F (0 - 500°C).
- °F or °C scale (user select in the configuration menu).
- Reversed thermocouple detection (no power to the heater, 0% output).
- Broken Thermocouple detection automatically switches to manual mode by applying the last stored percentage of power to the heater (adjustable through software).
- High and Low alarm.

1.3.2 TEMPERATURE CONTROL:

There are 2 control modes :

AUTOMATIC MODE (closed loop):

This is a self-tuning PID control unit. The controller continuously monitors the behavior of the heater which it is connected to. The controller adapts its output to the heater by automatically defining the P.ID. parameters.

MANUAL MODE (open loop):

In this mode, the controller sends the percentage of power stored in memory to the manual set point (default value: 20%). Note that this value can only be modified in the standby display. When the controller is in MANUAL mode, high and low alarms are no longer active. The same is true for the SoftStart function.

START UP PHASE (“SoftStart phase”):

This phase is designed to avoid cold start failures and extend the life of the heating element(s). It eliminates the thermal shock during the transition from cold to hot.

This phase also removes any moisture that may have collected in the heating element(s) by applying low power to the heater or by progressively increasing power to the heater.

There are 2 types of “SoftStart phases”.

- RAMP DURATION: Heating with maximum power limited to15% for a 5-minute period or up to a maximum temperature of 212°F (100°C).
- RAMP RATE: Applying a temperature rate expressed in °F / min ° (or °C / min) up to the user setpoint.

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Both ramp types can be activated to the following conditions:

- If the unit is in automatic mode during the start-up sequence.
- If the unit switches from manual to automatic mode.

1.3.3 POWER OUTPUT:

- Power output via 15 amp TRIAC (BTA24 800V).
- Double protection of the load via fuse (Ref : FA15 or ABC-15).
- Protection against over voltages (overvoltage switch calibrated to 275V).
- Phase angle or zero crossing mode (User selectable in configuration mode). This choice is only valid during the control phase. During SoftStart, the controller remains in "phase angle" mode for whichever power mode is selected.
- Accuracy: +/- 1% of nominal.
- Load security : Cut-off with software-driven relay. The relay cuts off the power to the heater under the following conditions :
  - Controller is powered down by pushing the ON/OFF switch.
  - Anti-Arcing system.
  - TRIAC short circuit detection.
  - Load or heater detection.
- Load or heater detection: automatic detection by current measurement: detection is determined by the following condition: If measured current is 0 and system call is positive. The controller then displays the message "Otr" (As open TRIAC or heater).
- Shorted TRIAC automatic detection: detection is determined by the following condition: If measured current is not 0 and if there is no system call (% power = 0). The controller then displays the message "Str" (as Shorted TRIAC).
- Automatic detection of load power variation: After a stabilization period of 120 seconds at the set temperature, the system computes and saves the value of the heater (In Watts). The controller generates an alarm (message "Hra": Heater alarm) if there is a variation of at least 20% from the saved value.

1.3.4 OTHER FUNCTIONS :

- Voltage correction (INCOE® Patent 6,107,610): the system uses a second closed loop control, which maintains the power applied to the heater if there is a line voltage variation. The system is active for voltages as low as 190 VAC.
- Anti arc pin detection: The controller can automatically detect the presence of an "Anti arc" pin on enclosure's edge connector. When this pin is detected, the system is active and this allows to cut the gate to the TRIAC, as well as the safety relay, when the controller is removed from the enclosure. The response time for this is less than 20 µsec. If no pin is detected, the system is simply not active.

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2.1 REQUIREMENTS FOR INSTALLING AND USING:

The control module is designed to operate in a dry industrial environment.

Operating Temperature range : from 14°F to +158° or -10°C to +70°C.

2.2 SAFETY REQUIREMENTS:

The controller is protected by :

- Fuses protect TRIAC against over current draw.
- Overvoltage safety feature for protection of the controller if in put voltage supply exceeds 275 V.
- Safety relay designed for protection of the heating element.

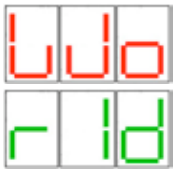
2.3 INSTRUCTIONS FOR INSTALLATION:

The controller can be installed in industry standard enclosures or cabinets. Before installing the control module make certain the module will fit into the cabinet. If there are any questions please contact INCOE®.

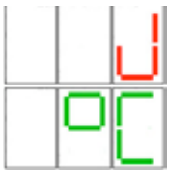
2.4 INITIAL START UP

- Install the controller(s) in the appropriate enclosure or cabinet.
- Connect the cabinet's power input cable to the facilities power supply.
- Check all wiring to and from the cabinet.
- Once connected to the plant power supply, turn on the cabinet using the circuit breaker on the cabinet.
- At start-up , the display will indicate its status by the display shown here:

- The controller type (World).

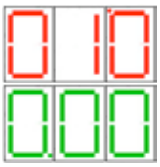


- The thermocouple type and the temperature unit (F or C) used.



- The plant facility's power supply frequency and the detection of the anti-arcing function (anti-arcing system detected, anti-arcing system undetected not detected).

- The version of the installed software.



- To Switch on the controller (keep the rotary knob pressed for 3 seconds).
- If the controller displays

, this means either the thermocouple is broken or is incorrectly wired. In this case, the controller does not apply any voltage to the heater (Except if "otc" parameter is set at "ON"). The problem needs to be corrected before continuing.
- If the controller displays

, it means the thermocouple is reversed. In this case, the controller does not apply any voltage to the heater. The problem needs to be corrected before continuing.
- If temperature when starting is below 212°F or 100°C, the SoftStart is activated.

In case of problems during start up, refer to the chapter "Instructions for maintenance".

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2.5 CONTROLLER OPERATING MODE:

2.5.1 DESCRIPTION:

This controller consists of the following:

A "CLICK & ROTATE" switch for data entry and viewing.

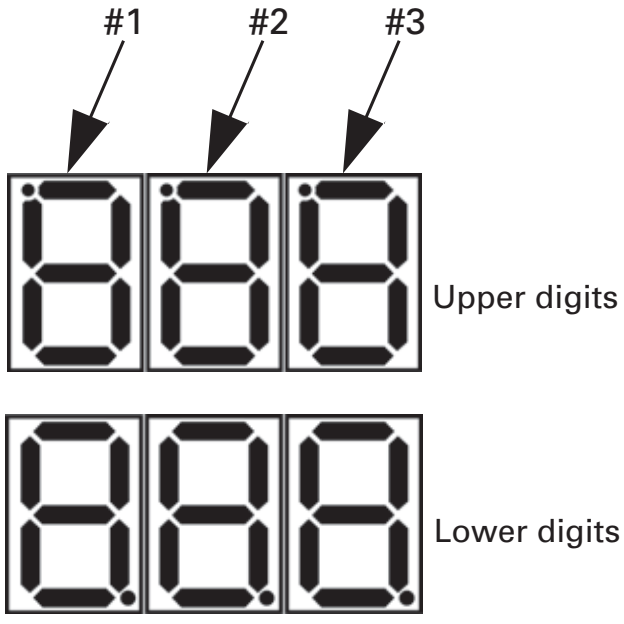
2 sets of 3 digits displays (7 segments + DP), the upper display is red (it is used for displaying temperatures, alarms and screen parameters), the lower display is green (it is used for displaying the temperature setpoint and the various other parameter values).

3 LED signals :

#1 : Auto/Manual, when lit controller is in Manual mode.

#2 : heating rate indicator (percentage of power display).

#3 : SoftStart Mode.



2.5.2 STANDBY DISPLAY:

In normal operating mode, the upper digits display the temperature whereas the lower ones display the setpoint.

If an alarm or a fault, occurs it will be displayed on the upper digits.

The "On / Off" and "Increase / Decrease" functions are the only ones operational in the standby screen display.

The 3 indicators (LED) will only be displayed on the upper display .

2.5.3 "CLICK & ROTATE" SWITCH OPERATING MODE:

A single switch is used for performing various tasks, This switch possesses several functions as outlined below.:

- 3 second button push = Switches the controller ON / OFF.
- 5 second button push to unlock if in Lock mode.
- A Double-click allows entry to or to exit from menu.

  i.e. From Stand-By display : a double click enters in to Main menu, and another double click exits the Main menu.
- 2 second button push = allows the selection of a parameter (Parameter is blinking) and the modification of it.
- If a parameter has been modified, another 2 second push is required to save value.
- Increase / Decrease (Turn right or left) = modify the parameters and to navigate through the different menus.
- The standby display becomes active again if the "Click & Rotate" switch remains untouched for 5 seconds.

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2.5.4 "CLICK & ROTATE" SWITCH LOCKING PROCEDURE:

If the LOC parameter is set to ON (in the configuration 2 menu), the switch is then automatically locked after 30 seconds if inactive. To temporarily unlock the switch, depress the knob for 5 seconds.

If the button is locked and depressed, then a "LOC" message will be displayed.

2.5.5 ALARM DESCRIPTIONS:

Alarms and faults only show in the standby Display, either in a fixed or blinking manner with the temperature value, as outlined below:

Open thermocouple fault:

- Continuous display of this fault in the standby display.

Reversed thermocouple fault:

- Continuous display of this fault in the standby display.

Disconnected heating element fault:

- This fault displays alternately with temperature. An open heater is automatically detected by current measurement. If the measured current is 0 and if the percentage of power is greater than 0, then this is detected as a load (heater) fault.

Shorted TRIAC fault:

- This fault displays alternately with temperature. A shorted TRIAC is automatically detected if the measured current differs from 0 and if the percentage of power =0.

Heating element load resistance fault:

- This fault displays alternately with temperature. Automatic detection of load nominal power variation. after a 120 second stabilization period of the temperature control (temperature +/- 3 °F / °C of setpoint), the system keeps the nominal power in memory and activates an alarm if there is a variation of at least –20% with respect to this nominal power.

Temperature high alarm:

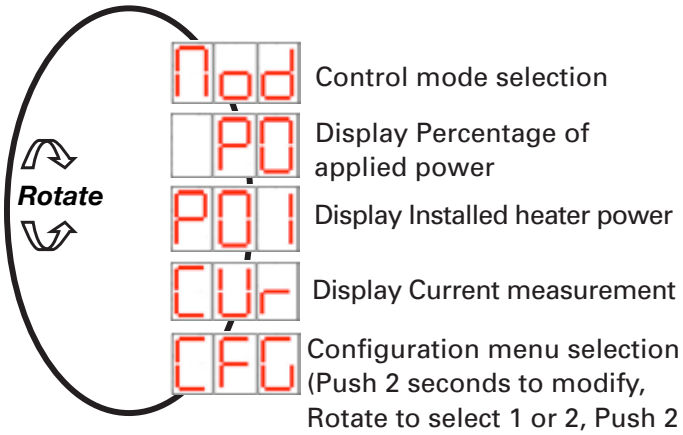
- This fault displays alternately with temperature. It displays when temperature is higher than the setpoint + parameter High alarm value, adjustable in configuration 1.

Temperature low alarm:

- This fault displays alternately with temperature. It displays when temperature is less than the setpoint parameters Low alarm value, adjustable in configuration 1.

2.5.6 OPERATOR INTERFACE MENU:

General View of Menu organization.
Main Menu (Double Click to enter or Exit).


Rotate
Control mode selection
Display Percentage of applied power
Display Installed heater power
Display Current measurement
Configuration menu selection (Push 2 seconds to modify, Rotate to select 1 or 2, Push 2 seconds again to confirm).

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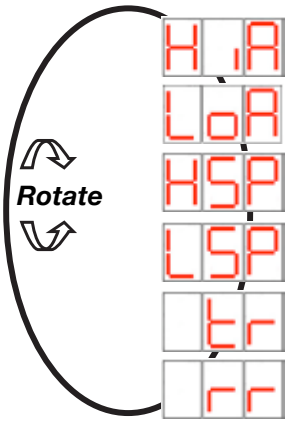
CFG 1 Menu (Double click to Exit).



High Alarm user select

Low Alarm user select

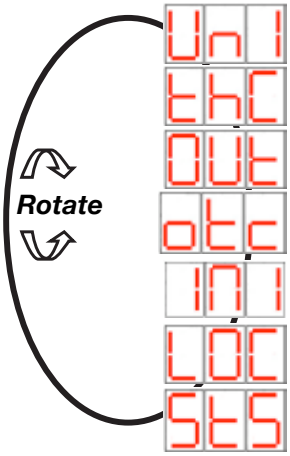
Maximum Setpoint user select

Minimum Setpoint user select

Time ramp user select

Ramp rate user select

CFG 2 Menu (Double click to Exit).



Temperature units selection

Thermocouple type selection

Output type selection

Operating mode if thermocouple fault

Initialization of controller parameters

Controller locking enabled

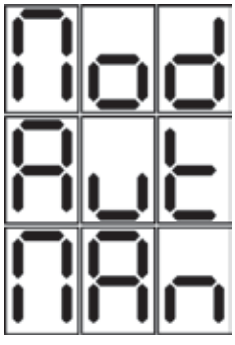
Controller state on re-start selection

2.6 MAIN MENU:

The main menu is as follows :

Control mode selection AUTO or MANUAL (AUTO by default):

Navigation via "Click & Rotate" switch:



If "Increase" display

If "Decrease" display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value and choose AUTO or MANUAL.

Confirm choice by pressing again for 2 seconds.

Display of the percentage of power applied to load (Heater) :

In manual mode, the value in the display corresponds to the manual output setting.

Navigation via "Click & Rotate" switch:

If "Increase" display

If "Decrease" display

If "Selected" (Push 2 seconds): no effect. Value in %.

Installed power display :

Navigation via "Click & Rotate" switch:

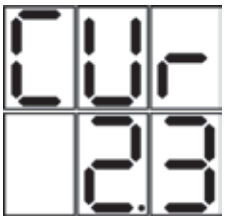
If "Increase" display

If "Decrease" display

If "Selected" (Push 2 seconds): no effect. Value in Watts.

Current measurement display :

Navigation via "Click & Rotate" switch:



If "Increase" display

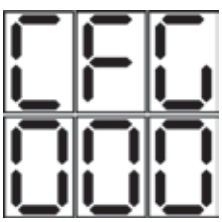
If "Decrease" display

If "Selected" (Push 2 seconds): no effect. Value shown in Amps.

Configuration menu selection:

Selecting parameters in the configuration menu (if the configuration entered does not correspond to any menu, then nothing happens when validating).

Navigation via "Click & Rotate" switch:



If "Increase" display

If "Decrease" display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value and choose 1 or 2.

Confirm choice by pressing again for 2 seconds.

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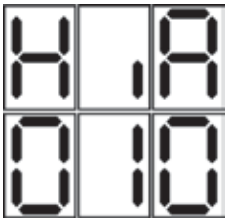
2.6.1 CONFIGURATION 1 MENU:

The configuration 1 menu is as follows :

High Alarm User Select :
Adjustable parameter setting allows for the number of degrees above the setpoint to be set (Default value: 5°F).

Navigation via "Click & Rotate" switch:

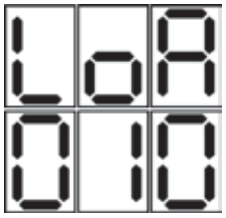


If "Increase" display
If "Decrease" display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value. Value in °F / °C.

Low alarm:
Adjustable parameter setting allows for the number of degrees below the setpoint to be set (Default value: 5°F/C°).

Navigation via "Click & Rotate" switch:



If "Increase" display
If "Decrease: display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value. Value in °F /° C.

Maximum setpoint User Select :
Adjustable parameter to limit the setpoint value to a maximum value (by default 500°C).

Navigation via "Click & Rotate" switch:

If "Increase"display
If "Decrease"display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value. Value in °F or in °C.

Minimum setpoint :
Adjustable parameter to limit the setpoint to a minimum value (by default 0°C).

Navigation via "Click & Rotate" switch:

If "Increase"display
If "Decrease"display

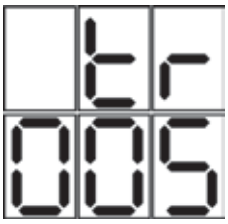
If "Selected" (Push 2 seconds): It is possible to modify the parameter value. Value shown in °F or in °C.

Time Ramp:
Adjustable parameter, which allows the user to define the Time Ramp for the SoftStart function.

This ramp is active if the temperature, when starting up is less than 212°F (100°C). Controller will heat at 15 percent for duration adjustable by the operator (from 0 to 99 min) (Default setting: 5 min).

This duration is stored in memory and will be used for every new ramp. NOTE: The Time Ramp cannot be modified nor cancelled while operating.

Navigation via "Click & Rotate" switch:



If "Increase" display
If "Decrease" display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value. Value shown in minutes.

Ramp Rate :
Adjustable parameter defining the second mode of the SoftStart function.

This mode is active if the parameter value differs from 0. This parameter is the Ramp Rate (Default setting: 0°F or °C /min).

Every minute, temperature is increased by a certain amount of degrees (0 to 99 °F/min or °C/min), and the percentage of nominal power is not limited.

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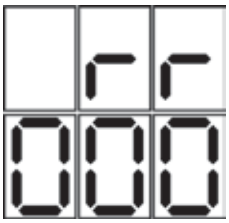
When temperature reaches setpoint, the ramp is complete. Its duration depends on the variation between setpoint and temperature and on the increase per minute selected.

While the ramp is operating, it is possible to modify the setpoint, which allows for adjustments whether the temperature is below or above the setpoint.

Example :
Initial temperature is 70°F, setpoint is 430°F, Rate Ramp is 60°F/min.

The ramp will last 6 minutes, because (430 - 70) / 60 = 6 steps of 60°.

Navigation via “Click & Rotate” switch:



If “Increase” display
If “Decrease” display

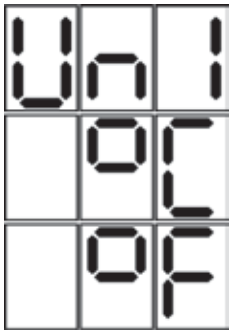
If “Selected” (Push 2 seconds): It is possible to modify the parameter value. Value in °F/min or °C/min.

2.6.2 CONFIGURATION 2 MENU:

The configuration 2 menu is as follows.

Temperature unit:
This parameter allows for the selection of the temperature unit, in either °F or °C.

Navigation via “Click & Rotate” switch:

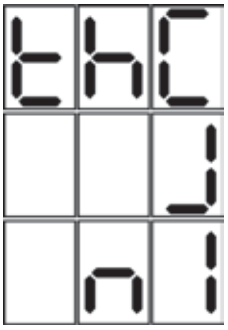


If “Increase” display
If “Decrease”display

If “Selected” (Push 2 seconds): It is possible to modify the parameter value. Value in °F or °C.

Thermocouple type:
Parameter allows the selection of the type of thermocouple used. Either a type J, or type K (displayed as “nl”). The default thermocouple is a J type.

Navigation via “Click & Rotate” switch:



If “Increase” display
If “Decrease” display

If “Selected” (Push 2 seconds): It is possible to modify the parameter value.

J Thermocouple / K thermocouple (displayed as “nl”).

Select type of output:
This parameter allows to select the type of output power, either Phase Angle mode (PhA), or Zero Crossing mode (0Cr). This selection is only valid during the control phase. During the SoftStart phase, the controller works in Phase Angle mode.

Navigation via “Click & Rotate” switch:

If “Increase” display
If “Decrease” display

If “Selected” (Push 2 seconds): It is possible to modify the parameter value. Value in Phase angle (Pha) or in zero crossing (0Cr).

Operating mode if thermocouple fault:
The percentage of power is saved in memory during the control phase, when in steady state.

(temperature stable at +/- 3° around setpoint, for at least 2 minutes).

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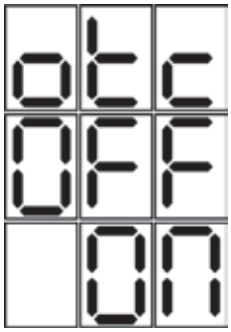
If this parameter is set at "OFF", the controller displays an "otc" alarm and does not apply any voltage to the heater when a thermocouple failure occurs.

If this parameter is set at "ON", when a thermocouple failure occurs , the controller switches automatically to MANUAL mode, modifies the manual setpoint using the percentage of power saved, and then applies this percentage of power on the heater.

Navigation via "Click & Rotate" switch:

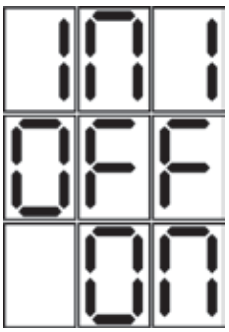


If "Increase" display
If "Decrease"display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value.

Controller parameters initialization:
This parameter allows the restore of all parameters to factory settings.

Navigation via "Click & Rotate" switch:



If "Increase" display
If "Decrease"display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value.

Controller locking:
This parameter allows for enabling or disabling the locking of the controller. By default, this parameter is set to OFF. If it is set to ON, the "Click and Rotate" switch locks up if it remains untouched for 30 seconds. To temporarily unlock it, a 5 second push is required.

Navigation via "Click & Rotate" switch:

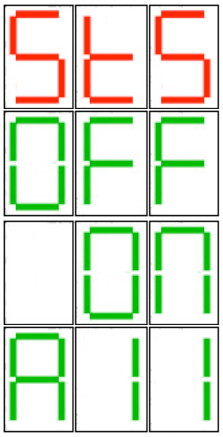
If "Increase"display
If "Decrease"display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value.

Controller State on re-start:
This parameter allows selection of the state of the controller when the controller is re-started when power is turned back on. If parameter is set at "OFF" and the main power is turned off, the controller will restart in the "OFF" mode when power is back on.

If the parameter is set at "ON" and the main power is turned off, the controller will restart in the "ON" mode when power is back on.
If the parameter is set at "All" and the main power is turned off, the controller will restart in the state it was prior to the main power being turned off.

Navigation via "Click & Rotate" switch:



If "Increase"display
If "Decrease"display

If "Selected" (Push 2 seconds): It is possible to modify the parameter value.

Parameter value: OFF, ON, or All (As it is).

IMPORTANT :

Any operation on the unit must be carried out by authorized personnel only.

Any part replaced must have the same characteristics.

Remove the main power to the cabinet before servicing.

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Fault	Effects / Tool	Display	Protections	Solutions
Open thermocouple	Temperature decrease.	The standby screen continuously displays the message "otc".	TRIAC command disconnection and stops heating.	Test the thermocouple with an ohmmeter, switch to manual mode.
"Pinched" thermocouple.	Overheating.	The standby screen displays the message "LoA" alternately with temperature.		Fix the pinching or switch to manual mode if you do not have have time.
Reversed thermocouple.	Temperature Decrease.	The standby screen permanently displays the message "rtc".		Check for proper wiring, Switch to manual mode.
Temperature Variations.	The actual temperature is unstable.	The standby screen displays the message "LoA" ou "HiA" alternately with temperature.		Material problem. Mould problem.
Heater disconnected.	Temperature Decrease.			Verify the connections Change the cartridge.
Heater partially disconnected.		The standby screen displays the message "LoA" alternately with temperature. The actual temperature drops on display.		H umidity too high : dry the heater and if necessary change it, Change the 16A fuse.
Grounded Heater		The standby screen displays the message "Otr" alternately with temperature. The temperature value decrease.	TRIAC command disconnection and stop of heating 16A fuse blown.	
Heater				Humidity too high : dry the cartridge and if necessary change it.
Triac shorted	Heater overheating.	The standby screen displays the message "Str" alternately with temperature. Temperature increasesing no control even in Manual Mode.	TRIAC disconnected and stops heating.	Send the controller to INCOE for repair.
Fuses blowing 16A in the fault zone.	The heater located in the mold does not heat.	The standby screen displays the message "Otr" alternately with temperature. Temperature setpoint decreases.		Change the faulty fuse.
The controller heats uncontrolable. Triac Shorted		The standby screen displays the message "HiA" alternately with temperature.		Check Po value (percentage of power used) , If 99.9%, the controller outout full power, Then either the thermocouple is in short-circuit, either the heater is cut or poorly connected, Check all the wirings as well as the resistance of the heater.
The controller does not light when switching on the cabinet.	No heating.	No displays.	No output to.	Check fuses located on the controller circuit board.

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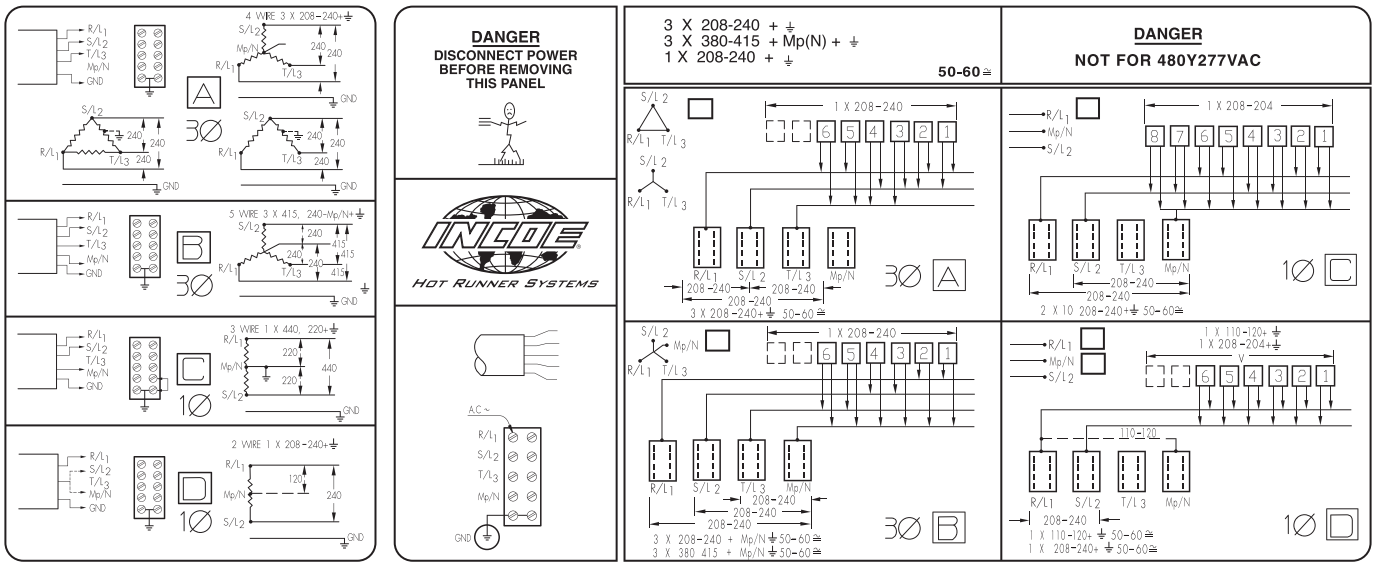
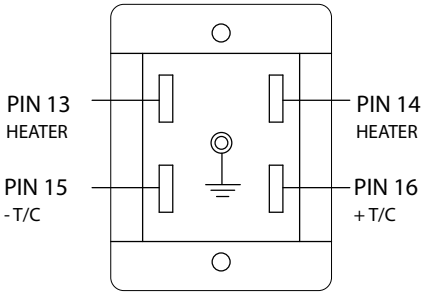
4.1 DIAGRAM LABEL



4.2 1 & 2 ZONE ENCLOSURES

S15405DB



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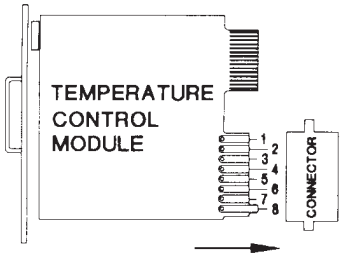
4.3 4 ZONE ENCLOSURES UTILIZING 1614-BRA

4 ZONE ENCLOSURES UTILIZING 1614-BRA

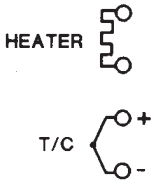
CONNECTOR FOR TEMPERATURE CONTROL MODULES TO PLUG INTO THE ENCLOSURE



	ENCLOSURE ZONES	ZONE 1	ZONE 2	ZONE 3	ZONE 4
1	+ THERMOCOUPLE	1	1	1	1
2	- THERMOCOUPLE	2	2	2	2
3	NOT USED	3	3	3	3
4	POWER OUT	4	4	4	4
5	POWER OUT	5	5	5	5
6	POWER IN	6	6	6	6
7	POWER IN	7	7	7	7
8	GROUND	8	8	8	8

HOT RUNNER SYSTEMS

MOLD POWER AND THERMO-COUPLE CON-NECTOR.



1	2	3	4
9	10	11	12
5	6	7	8
13	14	15	16

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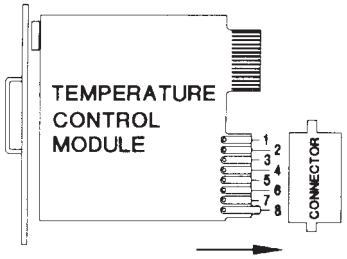
4.4 6 ZONE/8 ZONE ENCLOSURES UTILIZING 3214-BRA

6 ZONE/8 ZONE ENCLOSURES UTILIZING 3214-BRA

CONNECTOR FOR TEMPERATURE CONTROL MODULES TO PLUG INTO THE ENCLOSURE



	ENCLOSURE ZONES	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	ZONE 7	ZONE 8
1	+ THERMOCOUPLE	1	1	1	1	1	1	1	1
2	- THERMOCOUPLE	2	2	2	2	2	2	2	2
3	NOT USED	3	3	3	3	3	3	3	3
4	POWER OUT	4	4	4	4	4	4	4	4
5	POWER OUT	5	5	5	5	5	5	5	5
6	POWER IN	6	6	6	6	6	6	6	6
7	POWER IN	7	7	7	7	7	7	7	7
8	GROUND	8	8	8	8	8	8	8	8

HOT RUNNER SYSTEMS

HEATER

MOLD POWER AND THERMO-COUPLE CONNECTOR.

T/C

Rev 04/07

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32

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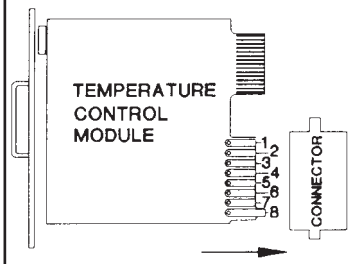
4.5 12 ZONE ENCLOSURES UTILIZING 4814-BRA

12 ZONE ENCLOSURES UTILIZING 4814-BRA

CONNECTOR FOR TEMPERATURE CONTROL MODULES TO PLUG INTO THE ENCLOSURE



	ENCLOSURE ZONES	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5	ZONE 6	ZONE 7	ZONE 8	ZONE 9	ZONE 10	ZONE 11	ZONE 12
1	+ THERMOCOUPLE	1	1	1	1	1	1	1	1	1	1	1	1
2	- THERMOCOUPLE	2	2	2	2	2	2	2	2	2	2	2	2
3	NOT USED	3	3	3	3	3	3	3	3	3	3	3	3
4	POWER OUT	4	4	4	4	4	4	4	4	4	4	4	4
5	POWER OUT	5	5	5	5	5	5	5	5	5	5	5	5
6	POWER IN	6	6	6	6	6	6	6	6	6	6	6	6
7	POWER IN	7	7	7	7	7	7	7	7	7	7	7	7
8	GROUND	8	8	8	8	8	8	8	8	8	8	8	8

HOT RUNNER SYSTEMS

HEATER	1	2	3	4	5	6	7	8	9	10	11	12
	13	14	15	16	17	18	19	20	21	22	23	24
MOLD POWER AND THERMO-COUPLE CON-NECTOR. T/C	25	26	27	28	29	30	31	32	33	34	35	36
	37	38	39	40	41	42	43	44	45	46	47	48

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5.1 GENERAL TERMS & CONDITIONS OF SALE

1 Applicable Law and Jurisdiction

These general terms and conditions apply to all proposals and quotations submitted by Seller, to all purchase orders received by Seller, and to all goods and services sold by Seller, except as other-wise specifically provided in a document signed by Seller. This sale or any sale resulting herefrom consists only of these terms and conditions and those in other documents which are referred to herein or are attached hereto or in a document subsequently signed by Seller and referencing this transaction (all of which constitute the "Agreement"). THE AGREEMENT SHALL BE GOVERNED, CONSTRUED AND ENFORCED UNDER THE LAW OF THE STATE OF MICHIGAN INCLUDING THE UNIFORM COMMERCIAL CODE IN FORCE ON THE INITIAL DATE OF THE AGREEMENT ("UCC"), EXCEPT AS PROVIDED HEREIN. The U.N. Convention on the International Sales of Goods shall not apply. Any services to be provided hereunder, whether or not they are otherwise ancillary to and part of a sale of goods (as separate units), shall be considered ancillary to a sale of goods and the UCC shall apply to all goods and services to be provided hereunder ("Goods"). **THE COURTS OF MICHIGAN SHALL HAVE EXCLUSIVE JURISDICTION OVER THE PARTIES AND THE CLAIMS ARISING UNDER OR RELATED TO THE AGREEMENT.** The parties stipulate to the convenience of Michigan courts in general, and Oakland Circuit Court in particular, as to all litigation. Any declaration of unenforceability of a provision shall be as narrow as possible and shall not affect the enforceability of the other provisions.

2 Formation, Integration and Modification

A. The Agreement supersedes all previous quotations and agreements pertaining to the Goods. Delivery to Seller of the Buyer's acceptance of a Seller's quotation (according to its terms), Seller's actions in reliance on Buyer's oral acceptance of a written or oral quotation, or Buyer's receipt of the Goods, will constitute a binding contract under the terms of the Agreement. The Agreement is subject to Seller's revocation or cancellation without liability until it is approved by Seller at its home office. Notice of such approval may be furnished to the Buyer in the form of an acknowledgment, shipment, or other form of express approval.

B. An order submitted by Buyer orally or in a purchase order or other writing (whether or not it contains terms or conditions modifying, adding to, repugnant to, or inconsistent with these Terms and Conditions), may be accepted, approved or filled by Seller, but any resulting contract and the liabilities or obligations of Seller shall be determined solely by the Agreement, and (unless the Seller otherwise advises Buyer in writing) notice is hereby given that Seller objects to any such terms or conditions in Buyer's purchase order or other writing. Seller shall not be deemed to have in any way enlarged or modified its liabilities or obligations under the Agreement by filling such order or by failing to further object to Buyer's terms or conditions.

C. The Agreement is a final, complete and exclusive statement of the Agreement of the parties. THE SELLER IS WILLING TO NEGOTIATE WRITTEN CHANGES TO THESE TERMS AND CONDITIONS, BUT RESERVES THE RIGHT TO MAKE AN ADJUSTMENT IN THE PRICE OF THE GOODS. No modifications, limitations, waivers or discharge of the Agreement or any of its terms shall bind Seller unless in writing and signed by Seller's authorized employee at its home office. Notwithstanding anything to the contrary in this Agreement, no modifications, limitation, waiver or discharge of any provision of the Agreement shall affect the Buyer's liabilities to Seller accrued prior thereto. Seller may correct unilaterally any mathematical and typographical errors in the Agreement. Typed provisions of the Agreement take precedence over printed provisions. A course of performance, course of dealing, or customs in the trade shall not constitute a modification or waiver by Seller of any right by Seller.

D. The Agreement is only for the benefit of the parties, except all disclaimers and limitations applicable to Seller shall be for the benefit of Seller's agents, employees, contractors, and suppliers. If any provisions are determined to apply to third parties, all other provisions including limitations, waivers, and disclaimers shall also apply.

3 Prices, Payment and Risk of Loss

A. Prices contained in Seller's published price lists, if any, are subject to change without notice. Prices contained in individual written quotations or proposals are firm only for a period of thirty (30) days from the date of the quotation after which Buyer should inquire of Seller as to their validity and request a written confirmation or revision. Prices do not include taxes and Buyer shall pay all applicable sales or other taxes levied with respect to Goods (and replacements) and the Agreement, unless exempt therefrom. All prices are in United States dollars. Buyer shall pay all government fees levied on the installation and inspection of the Goods. Buyer shall pay upon receipt all invoices rendered by Seller for any such items Seller may pay and for the Goods.

B. This Agreement is for a shipment contract and the Goods shall be delivered F.O.B. Seller's dock. Whether or not Seller prepays shipping charges, risk of loss passes to Buyer upon tender of the Goods to a carrier. Seller's breach of the Agreement shall not affect the passing of the risk of loss to Buyer notwithstanding any provision of law to the contrary.

C. Seller may unilaterally increase prices to cover increased costs (plus reasonable overhead and profit) of design, materials, and manufacturing required by changes requested by Buyer after the date of any quotation.

D. All amounts not paid to Seller when due shall incur a carrying charge of 1.5% per month to the extent allowed by law and otherwise at the highest written contract rate allowed by law.

E. All amounts due on installation or other event which requires the action or cooperation of Buyer which Buyer fails to supply timely shall become due upon such failure.

4 Delivery

Shipping dates are estimates based on Seller's present engineering and manufacturing capacity and scheduling, and may be revised by Seller upon receipt or scheduling of Buyer's order. All shipping dates are approximate and shall be computed from the date of entry of the order on Seller's books. All shipping dates are further subject to Seller's prompt receipt from Buyer of a written purchase order or acceptance, letter of credit, down payment, and other conditions as specified in the Agreement, and of all drawings, information and approvals necessary to provide Goods and to grant any credit proposed in the Agreement.

5 Delay of Shipment or Performance Excused for Various Reasons

A. If shipment of any item or other performance by Seller is delayed at the request of or due to the fault of Buyer, Seller may at its option hold the item at the place of manufacture at the risk and expense of the Buyer from the time it is ready for shipment. In the event of any such delay in shipment, full and final payment for an item shall be due and payable thirty (30) days after the Buyer is notified that the item is ready for shipment. If the Seller is unwilling to accommodate the Buyer by holding such item, the Buyer shall accept shipment immediately.

B. Dates for Seller's performance are estimates only. In addition, the Seller shall not be in default because of its delay or failure to deliver or perform resulting, in whole or in part, from: (i) any foreign or domestic embargoes, seizures, acts of God, insurrections, war, or the adoption or enactment of any law, ordinance, regulation, ruling or order, or (ii) the lack of usual means or transportation, fires, floods, explosions, strikes or any other accidents, contingencies, or events, at the Seller's or its supplier's plant or elsewhere (whether or not beyond the Seller's control) which directly or indirectly interfere with, or render substantially more burdensome, Seller's production, delivery, or performance.

6 Inspection, Testing and Rejection

A. If the Agreement expressly provides for Buyer's inspection and/or acceptance of the Goods, Seller's standard test procedures conducted by Seller's representative shall be the criteria for inspection and/or acceptance, unless other specific procedures have been specified in the Agreement.

B. All drawings, specifications, technical documentation, samples, prototypes and Goods shall be deemed approved and/or accepted by Buyer if Buyer does not provide a written objection and/or rejection within seven (7) days of receipt or other reasonable time established by Seller. Any objection and/or rejection by the Buyer must be in writing and state with specificity all defects and non-conformities upon which Buyer will rely to support its rejection. ALL DEFECTS AND NON-CONFORMITIES WHICH ARE NOT SO SPECIFIED ARE WAIVED.

7 Installation and Start Up

All Goods shall be assembled and installed by and at the expense of the Buyer. Seller may furnish, upon request and without additional cost or liability to Seller, written instructions for installing, maintaining, and operating the Goods. At Buyer's request and cost, Seller may furnish personnel and equipment to assist in the installation and/or start up of the Goods. Buyer shall pay Seller its prevailing per diem rates for such personnel and equipment plus reasonable transportation, food, lodging and other travel expenses. Buyer shall have competent supervisory, maintenance and operating personnel present when Seller's personnel are performing such services.

8 Software License

The Seller grants the Buyer, for its internal use only, a non-exclusive perpetual license ("License") of all user manuals, software programs, firmware, and storage media ("Software") provided by the Seller in conjunction with the Goods with which the Software is provided, for the sole purpose of the operation of the Goods. This License terminates automatically if Buyer is in default of its obligations. The Software may be provided in machine readable object code only. Licensee may make and keep one copy of the object code, if provided by Seller, for backup purposes. When making a copy, the Buyer shall reproduce all Seller's copyright or patent notices in all forms originally included in the Software. Buyer shall not make any effort to obtain or reproduce the Software's source code. Title and all ownership rights to the Software remain with Seller, its licensors, or its suppliers. The Software is the proprietary information and trade secret of the Seller or its licensors, whether or not any portion thereof is or may be validly copyrighted or patented. The License may not be assigned nor transferred by Buyer except as a part of a transfer of the Goods with-out the written consent of Seller which may be withheld. The Software is provided for the Buyer's internal use only and the Buyer shall maintain the confidential nature of the Software and related materials and protect them against disclosure or improper use. Buyer shall pay all taxes based on the Software or use of the Software, however designated or levied, except those based on Seller's net income. All disclaimers and limitations applicable to the Goods apply to the License.

9 General Express Warranties

A. Seller warrants to Buyer only, that Goods (or portions thereof manufactured by Seller) shall be free from manufacturing defects in materials and workmanship which are discovered within the warranty period, subject to the disclaimers and limitations of the Agreement. This is not a warranty of performance, but a limited warranty as to the condition of the Goods at the beginning of the warranty period. The warranty period, measured from date of shipment by Seller, shall be: one year for hot runner systems and components (other than heaters and thermocouples); three years for defects causing leakage for DFQ bushings; three years for cast (pro-rated) and DF heaters; one year pro-rated for screen pacs, fast cycle bushings, and KX heaters; six months for thermocouples; two years for temperature and valve gate controllers (reduced to six months for electronic components); one year for quick mold change products; and 90 days for all other Goods. The percentage of the replacement cost shall be reduced by three percent for each full month from 90 days after the date of shipment for the cast heater warranty and by 50% and 75% at the end of six and nine months, respectively, after shipment for the screen pac, fast cycle bushings, and KX heater warranty. Because the Goods may be subject to a wide variety of use, installation, maintenance and cleaning, the warranty is only against such defects and not against any other failures such as, but not limited to, those due to wear and tear, and normal maintenance and perishable items are excluded from this warranty against defects.

B. Seller warrants to Buyer that the Goods will be as described in the Agreement in all material respects, subject to the limitations stated herein and Seller's published and internal standards; however, Seller retains the right to change the dimensions, composition, design, performance, color and appearance of the Goods without liability if, in its judgment, the change is non material. Seller may, in its discretion, also rely on any generally accepted industry standards.

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C. Seller's warranties shall apply only if the Goods: (i) have been installed, maintained, and used in conformity with instructions furnished by Seller from time to time, if any; (ii) have been subjected to normal use for the purpose for which Goods were designed;

(iii) have not been subjected to misuse, negligence, or accident; and, (iv) have not been altered or repaired by persons other than Seller in any respect which, in the judgment of Seller, adversely affects the condition or operation of the Goods.

10 Patent Express Warranties

Seller shall defend and indemnify Buyer from any claim which asserts that the Goods or their inherent methods of operation, intrinsically, infringe any United States patent, except as to a claim based on Buyer's use of the Goods as a step in an overall process or as an element in an overall combination. Seller's obligation shall not apply to a claim based on Goods or portions thereof specified, designed, or manufactured by Buyer. Buyer shall notify Seller promptly of any assertions of patent infringement and provide Seller with assistance and information requested by Seller, or Seller shall have no further obligation to defend or indemnify. Seller shall defend with its counsel or other counsel of its choice and shall have the sole right, without consultation with Buyer, to take all action Seller deems appropriate to prosecute or settle such claims. Seller's exclusive obligation to indemnify as to Goods declared to infringe is limited to the acquisition of a license, the replacement of Goods with non-infringing goods, the modification of the Goods so that they are non-infringing, or the return of the purchase price and shipping costs in exchange for the Goods, as Seller may elect. This section states the Seller's entire and exclusive obligation regarding patent infringement.

11 Disclaimer and Limitation of Express Warranties

There are no express warranties other than those contained in the Agreement. Any representations as to performance and other matters, except as contained in the Agreement, were for illustrative purposes only and do not constitute a warranty. Whether or not the Goods are to be used exclusively by Buyer, there shall be no third party beneficiaries to the express warranties contained herein. Seller does not warrant any portion of the Goods not manufactured by or not furnished by Seller (whether or not specified by Buyer), but Seller shall assign to Buyer upon request all assignable warranties of Seller's suppliers related to such Goods. All descriptions, shipping specifications and illustrations of the Goods or the Seller and its quality and other systems and capabilities in catalogues, brochures and price lists or otherwise provided by the Seller are intended for general guidance only and the Seller is not responsible for any errors or omissions therein or for any loss or damage resulting from reliance on them. Seller does not warrant that it or the Goods are in compliance with any entity, organization or industry standards, guidelines, or procedures unless specifically contained in the Agreement.

12 Remedy and Limitation of Seller's Liability

A. Defective or non-conforming Goods discovered and returned during the warranty period shall be repaired, or replaced by Seller without any additional charge and shipped to Buyer, FOB Seller's plant, for reinstallation by Buyer at its cost, subject to the terms hereof. The warranty obligation of Seller is limited to the repair or replacement at Seller's plant of any part of the Goods which Buyer shall, within the warranty period, return to Seller, with transportation charges prepaid by Buyer, and which Seller shall determine upon examination to be defective or not in conformity with the express warranties contained herein. In lieu of repair or replacement, if Seller elects, Seller may, upon return of such Goods and making a determination of non conformity or defect, keep the Goods and refund the purchase price. Buyer's remedies shall be limited **(even in the event of Seller's default of its warranty obligations)** exclusively to those provided in this section. **UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES.** Buyer waives any causes of action or theories of liability including, but not limited to, those arising under contract, tort, strict liability, product liability, statutes, or otherwise, except as specifically provided by the UCC as modified and limited herein. The replacement or repair of Goods by the Seller does not give rise to any new warranty except the warranty period provided for herein shall be extended by the length of any period from the date the defective or non conforming Goods are received by the Seller until the date repaired or replacement Goods are delivered to Buyer.

B. Buyer must contact Seller requesting warranty coverage plus a return authorization number and other instructions for the return of Goods to Seller or other instructions. If requested by Seller, Buyer shall issue a new purchase order or amendment to Seller for replacement parts, subject to Seller issuing a credit memo if Buyer's claim for warranty coverage is approved. Buyer must comply with Seller's return instructions (including return of the Goods) within 30 days or the claim shall be deemed conclusively to have been abandoned. Buyer is responsible for properly tagging, identifying, and packing returned Goods. Goods returned without compliance with the above procedures shall be returned to the sender at sender's cost.

13 Disclaimer of Implied Warranties

THE SELLER DISCLAIMS ALL IMPLIED WARRANTIES (OTHER THAN GOOD TITLE) INCLUDING BUT NOT LIMITED TO THOSE OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, AND NON-INFRINGEMENT. Seller does not warrant the Goods will comply with the requirements of any safety or environmental code or regulation of any federal, state, municipality or other jurisdiction beyond the specific express warranties in this Agreement.

14 Parts, Service and Training Performed by Seller

All warranty and non-warranty parts, inspection, labor, service, software, and training, if any, provided by the Seller or its agents and contractors (including those provided under purchase orders subsequent to the Agreement) related to the Goods are subject to all limitations and disclaimers of warranties and remedies provided in the Agreement. The Seller may have access to the Goods during or after installation of the Goods. The Seller is not under any duty to inspect the Goods for any defects or any improper use or modification of the Goods nor to correct or advise the Buyer of any such condition, use or modification, which is observed. Any notification which may be given is voluntary and subject to all limitations and disclaimers in the Agreement.

15 User's Responsibility for Safety

It is Buyer's or other user's responsibility to provide all proper dies, devices, tools, training, and other means that may be necessary to effectively protect all personnel from serious bodily injury which otherwise may result from the method of particular installation, use, operation, or service of the Goods. Manuals furnished by Seller; ANSI Safety Standards; EPA, OSHA and similar state regulations; and other sources should be used by Buyer to insure the safe use of the Goods. If Buyer fails to comply with the obligations set forth in this section, Buyer shall indemnify and save Seller harmless from any liability or obligation incurred by Seller to persons injured directly or indirectly in connection with the operation of the Goods and all warranties of Seller shall become automatically void.

16 Indemnification

Buyer shall indemnify the Seller from any and all third party claims, damages, and expenses (including reasonable attorney fees) under theories of tort, product liability, negligence (ordinary or gross), warranty, contract, statute, or otherwise arising out of the use, storage, sale, processing or other disposition of the Goods, supplies or materials used in connection with the Goods, or parts manufactured with the Goods, if the action or inaction of the Buyer or its employees, customers or agents, or the Buyer's design specifications, were a material or proximate cause of injuries or damages giving rise to claims against the Seller.

17 Consequential, Incidental, and Other Damages

BUYER AND THIRD PARTIES SHALL NOT BE ENTITLED TO ANY CONSEQUENTIAL, PUNITIVE, EXEMPLARY, OR INCIDENTAL DAMAGES, AS DEFINED IN THE UCC OR OTHERWISE. **This limitation shall be enforced regardless of whether Seller has defaulted in its warranty or other obligations.** Any legal inability to limit or restrict the right of the Buyer or a third party to such damages shall not affect the right of Seller to indemnification hereunder, and under no circumstance shall Buyer recover more than the purchase price.

18 Security Interest, Power of Attorney

In addition to any security interest granted by the UCC, the Buyer hereby grants a security interest to the Seller in all Goods and documents related thereto and proceeds and products therefrom to secure all obligations of the Buyer to the Seller, whether or not arising under the Agreement. Buyer shall sign financing statements evidencing the security interest as reasonably requested by Seller, or Seller may file a copy of the Agreement or portion thereof as a financing statement. Buyer grants Seller an irrevocable power of attorney to sign Buyer's name to a financing statement if necessary or convenient to perfect Seller's security interest. In case of a default by Buyer, Seller may peaceably enter the premises of the Buyer and others to repossess or render inoperable all Goods in which it has a security interest.

19 Proprietary Information

A. Buyer acknowledges that any information disclosed to Seller has not and will not be confidential or a trade secret unless clearly and conspicuously noted on the disclosure, or in some other writing delivered to Seller at or prior to the time of the disclosure. Otherwise, Seller shall be under no obligation to refrain from using in its business any information, manufacturing processes or unpatented disclosures which may pass to it from Buyer in the performance of the Agreement

B. All proposals, plans and other information furnished by the Seller in bidding, negotiating and performing the Agreement, are confidential and the property of Seller and shall not be shown or disclosed to any other bidder, and shall not be shown or disclosed to any third party or used by Buyer except as may be necessary for the selection or use of the Goods.

C. Any invention or other information developed by Seller in the performance of the Agreement shall remain the property of Seller.

20 United States Government Regulations

The Buyer shall not engage in any transaction with respect to the Goods which violates any statute or regulation of the United States of America.

21 Certifications

Seller certifies that any Goods produced in the United States shall be produced in compliance with all applicable requirements of Sections 6, 7 and 12 of the U.S. Fair Labor Standards Act, and of the regulations and orders of the U.S. Department of Labor issued under Section 14 thereof. No other certifications or waivers regarding payments to Seller's suppliers or laborers are required.

22 Time for Bringing Action

Any proceeding by the Buyer for breach of the Agreement or any other right against Seller arising from or in connection with the payment cannot be filed nor maintained unless: (i) it is commenced within one (1) year after the cause for action has accrued; (ii) Buyer has given timely written notice to Seller of its claim as provided herein; and (iii) Buyer deposits the unpaid portion of the purchase price with the tribunal pending final adjudication. An action shall accrue no later than shipment of the Goods.

#330439 (2/21/01)

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6.1 GLOBAL SERVICE CONTACTS

In case of problem or for any further information, please use the contact information below, or visit www.incoe.com.

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These products are covered under one or more of the following Patents: USA 5,269,677; 5,660,369; Canada 2,062,903; Germany 4028660; 4324275; Japan 2,093,613; and other foreign patents pending.

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